A METHOD OF KILLING ORGANISMS AND REMOVAL OF TOXINS IN ENCLOSURES

FIELD OF THE INVENTION

This invention relates to methods of sanitizing buildings and other enclosed spaces by killing and removing organisms such as insects, bacteria, virus, dust mites, spiders, silver fish, fungi and toxic molds such as but not limited to aspergillus oryzae, aspergillus terreus, aspergills versicolor, cladosporium hergbarum, stachybotrys chartarum, penicillium aurantiogriseum, pencillium chrsogenum, pencillium glabrum and fusarium oxysporum.

BACKGROUND OF THE INVENTION

A large number of methods have been developed for killing insects, such as termites, in buildings. The most widely used method is tenting the building, then filling the building with a toxic gas for a period of time sufficient to kill termites or other selected insects. This method is effective for killing termites and other insects. However, this method generally requires 12 hours to be effective, requiring building occupants to move out businesses to be closed for approximately a three day period to insure proper venting of toxic material and/or gas. Tenting the building with heavy tarpaulins requires workers to walk and arrange the tarpaulins on the roof, often damaging shingles or other roofing materials. Food and medications must be

placed in sealed containers or removed. Generally the entire building must be treated, even if the infestation is localized.

Because of the disadvantages of the toxic gas method, various other techniques of varying effectiveness have been developed, using heated air or very cold air to kill termites, electrical "shock" treatments, irradiation, non-ionizing, etc.

Typical of these is the method disclosed by Charles Forbes in U.S. Patent No. 4,817,329, in which wood destroying insects, e.g., termites, are killed by applying a heated gas, such as heated air, to wooden surfaces until the building surfaces are heated to a temperature, typically about 120 to 135°F. Temperatures for killing other insects are said to be surprisingly close to this range. This method has been found to be very effective for killing termites. However, this method, using the described temperatures, is not effective for other organisms, such as fungi, and toxic molds such as, but not limited to, aspergillus oryzae, aspergillus terreus, aspergills versicolor, cladosporium hergbarum, stachybotrys chartarum, penicillium aurantiogriseum, pencillium chrsogenum, pencillium glabrum and fusarium oxysporum. Further, many insects such as mites, fungi, molds and the like are a serious health hazard even when dead. Many people are allergic to the dust-like remains of these organisms that can also cause serious health problems. This is a particular problem to persons suffering from asthma, bronchitis, pneumoconious and other respiratory ailments.

Therefore, there is a continuing need for improved methods of killing organisms in enclosures such as buildings that are fully effective in killing and eliminating substantially all such organisms, is non-toxic, can be performed in a relatively short time, is clean, dry and odorless, and removes a large proportion of the dead organisms.

SUMMARY OF THE INVENTION

The above-noted problems, and others, are overcome in accordance with this invention by a method which basically comprises the steps of preparing the enclosure to be treated, such as a building by, removing all heat sensitive items, positioning heat shields, etc., positioning temperature indicating probes at appropriate locations, inserted into building structure, open spaces, etc., installing ingress ducts through which an environmentally acceptable gas, such as air, can be directed into the enclosure, allowing the gas to leave the enclosure by opening windows, doors, etc. or by installing an egress duct or ducts for this purpose, heating the gas and directing it into the ingress duct(s) when installed and filtering gas exhausting through open doors and windows and/or the egress ducts to collect organism remains and prevent them from entering the environment.

To increase system effectiveness, under some conditions, it

is preferred that a suitable quantity of ozone be fed into the heated air passing through the ingress ducts. Ozone aids in killing many organisms and will eliminate any chemical fumes, odors, etc. that may result from the treatment.

To increase gas flow through the enclosure when egress ducts are employed, it is preferred that a vacuum extraction system be provided downstream of the filters receiving gas from the egress ducts. This will assure that almost all gas leaving the enclosure will pass through the filters and increase the capture of organism remains.

It is, therefore, an object of this invention to provide a non-toxic method for destroying a wide variety of organisms including fungi, toxic molds such as, but not limited to, aspergillus oryzae, aspergillus terreus, aspergills versicolor, cladosporium hergbarum, stachybotrys chartarum, penicillium aurantiogriseum, pencillium chrsogenum, pencillium glabrum and fusarium oxysporum and insects in enclosures such as buildings and the like.

Another object of the invention is to remove substantially all of the remains of the killed organisms from open areas in the enclosure.

Yet another object is to filter gases leaving from the enclosure to prevent the allergenic organism remains from entering the environment.

A further object is to accomplish the destruction of the

organisms in a relatively short period.

Still another object is to monitor the temperature level throughout the enclosure to assure that all areas reach the predetermined effective temperature.

BRIEF DESCRIPTION OF THE INVENTION

Details of preferred embodiments of the invention are provided in the drawings, wherein:

Figure 1 is a schematic diagram showing components of the system of this invention; and

Figure 2 is a flow diagram of the method of this invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to Figure 1, there is seen a schematic diagram showing the components of the kit of this invention in use treating an enclosure 10. Typically, enclosure 10 may be a house, barn, shed, a business building or some portion of such a building. An enclosure 11, such as, but not limited to conventional tenting may be required to treat the exterior surface of enclosure 10.

A plurality of temperature sensors 12 are positioned at predetermined locations to monitor temperature of the structure. Typically, these sensors have thin, elongated, tips that can be adhered to or pushed into wood or other materials or into suitable sized holes drilled into such material so as to measure

the surface and/or internal temperature. Sensors 12 may be wired to a console 14 which displays and records the temperature at each sensor in real time for future reference. Alternatively, the sensors may be wireless or infrared, transmitting a signal to console 14. Typical sensors, as for way of example and not by way of limiting, include thermal couples, thermistors, or the like connected to a computer and/or a strip chart recorder. Thermocouples can be purchased from Togam under the model number 875F or any other commercial vendor having an equivalent sensor.

One or more heaters 16 heat a gas to the predetermined temperature. Preferably, the gas is air, although any other environmentally acceptable gas, such as nitrogen, may be used if desired. The gas is heated to at least a temperature lethal to the organisms to be destroyed. For a more complete disinfection, the gas temperature is preferably at least about 155°F, with optimum results generally be achieved with temperatures in the range of about 120 to 300°F.

Any suitable heater may be used. A gas burning heater, such as a conventional propane heater is preferred as being particularly efficient in heating air. Any other heating arrangement, such as electrical heaters, may be used if desired.

Heated gas from one or more heaters 16 is directed to a blower 18 (which may, if desired, be a component of the heater) which directs the hot gas into enclosure 10 through at least one ingress duct 20. Generally, a plurality of ducts 20 will be used

to achieve the optimum distribution of hot gas throughout enclosure 10. Ingress ducts 20 preferably include variable flow dampers and may be moved while the system is in operation to achieve uniform temperatures in all areas being treated of the structure, as sensed by sensors 12 and observed at console 14.

When utilized, at least one egress duct 22 is provided to allow the gas to leave the structure. While it is preferred that enclosure 10 be maintained at a pressure slightly above atmospheric pressure as the hot gas brings the building elements up to the desired surface and penetration temperatures, the positive pressure differential allows the hot gas to vent through open windows, doors, etc. to and carries away the remains of the destroyed organisms upon venting. When the structure is sealed the duct or ducts 22, like the open windows and doors, caries away the remains of destroyed organisms. A filter assembly 24 receives gas from an egress duct 22 and removes the remains of the organisms preventing them from reaching the environment. Typical filters are available from Therma-Stor Products, Madison, WS, under the Guardian HEPA system designation as for example and not by way of limitation, a UV filter is desired, however other filters suitable for the purpose intended can be utilized.

For optimum effectiveness, it is often desirable to increase gas flow rates by adding a blower 26 or other gas extraction means downstream of filter 24 to aid in extracting the gas from enclosure 10. This forced extraction increases the efficiency of

filtering of the gas by filter 24.

In some applications, the introduction of ozone gas from ozone generator 28 into blower 18 or ingress duct 20 is highly desirable. This results in oxidation of organic contamination, such as molds where layering has occurred. Ozone generators suitable for use here are available from RGF O^3 Systems, Inc., under the TURBOZONE® trademark. Equivalent ozone generators suitable for the purpose intended can be used for the purpose.

In the operation of the system of this invention, the first step is to prepare the building, as indicated in block 30 of Figure 2. This basically involves removing all heat sensitive items from the enclosure or, in some cases, covering heat sensitive items with thermal insulation material. All material that has a flash point below the maximum temperature to be used must be removed.

Next, a plurality of temperature indicating probes are placed in predetermined locations within the enclosure as indicated in block 32 to assure that the required temperature levels are achieved. In some cases the probes can be read directly, although preferably they are connected by wires or wireless means to a console, so that all probes can be monitored conveniently and the data recorded in real time.

At least one ingress duct and when the enclosure is sealed at least one egress duct are then installed as indicted in block

34. Generally, a plurality of ingress ducts is preferred. Although each duct may enter the enclosure separately, the use of one ingress entry duct connected to a manifold from which plural ducts extend to predetermined locations within the enclosure is preferred. When filtering the exiting gas, ducts may enter through any suitable opening, such as an open window or door with the remainder of the window or door blocked by a panel.

When everything is positioned, the gas (preferably air) is heated as indicated in block 36 and directed into the ingress duct(s), as indicated in block 38. If desired, ozone can be optionally added to the gas stream at this point, as indicated in block 40.

Air leaving through egress ducts may be filtered to remove the remains of the destroyed organisms, as indicated in block 42. The filter system will inherently impose some back pressure on the egress ducts and enclosure. Back pressure is desirable to assure surface exposure and penetration of the heated gas to all parts of the enclosure, but excessive back pressure should be avoided. Therefore, it is generally desirable that an air extraction system, as indicated in block 44, be included to increase air flow through the filter system and limit back pressure.

At any time during system operation, the ingress and egress ducts may be moved to assure uniform temperatures throughout the structure, as indicated by the temperature probes and temperature

monitoring console.

Flow of the heated air through the enclosure will generally be continued for about 1 to 6 hours to provide optimum results. Usually the entire operation from preparation of the building to removal of the equipment will take six to eight hours.

While certain specific relationships, materials and other parameters have been detailed in the above description of preferred embodiments, those can be varied, where suitable, with similar results. Other applications, variations and ramifications of the present invention will occur to those skilled in the art upon reading the present disclosure. Those are intended to be included within the scope of this invention as defined in the appended claims.

I CLAIM: